

CLAIMS:

1. A method for processing at least one plant stalk having a fibrous outer part (skin) and an inner hurd, the method comprising the steps of:
 - striking the stalk(s) at at least one location along the stalk length so as to cause
 - 5 the stalk(s) to bend at the at least one location thereby causing fracture of the hurd across the stalk(s) at each striking location so as to expose at least part of the hurd; and separating at least part of the hurd from the skin.
2. A method according to claim 1 wherein at least part of the skin is also caused to
- 10 split on contact with the striking means so that upon striking, at least part of the outer skin fractures across the stalk and the skin splits longitudinally at least at the location at which the stalk has been struck.
3. A method for processing at least one plant stalk having a fibrous outer part
- 15 (skin) and an inner hurd, the method comprising the steps of:
 - feeding the stalk(s) to a bending element;
 - striking the stalk(s) with one or more striking means to cause the stalk(s) to bend over the bending element so as to fracture the hurd across the stalk; and
 - separating at least part of hurd from the skin.
- 20 4. A method according to claim 3 wherein at least part of the skin is also caused to split on contact with the striking means so that upon striking, at least part of the outer skin fractures across the stalk and the skin splits longitudinally at least at the location at which the stalk has been struck
- 25 5. A method according to any one of the preceding claims wherein the bending element is a blunt bending element.
6. A method according to any one of the preceding claims wherein the bending
- 30 element has a small radius edge.
7. A method according to any one of the preceding claims wherein the bending element is in the form of, or forms part of, a plate.
- 35 8. A method according to any one of the preceding claims wherein the bending element is in the form of a blade.

9. A method according to any one of the preceding claims wherein the bending element is in the form of a hump.
- 5 10. A method according to any one of claims 3 to 9 wherein the at least one plant stalk is struck by a plurality of striking means so that when the stalk(s) are fed to the bending element, substantially contiguous portions of the stalk(s) are subjected to fracture and/or splitting followed by removal of the skin.
- 10 11. A method of according to any one of claims 3 to 10 wherein the one or more striking means may be sequentially delivered to the bending element.
12. A method of according to any one of claims 3 to 11 wherein the one or more striking means are delivered to the bending element by means of a conveyor or a rotor.
- 15 13. A method according to any one of the preceding claims wherein the stalk is manually fed to bending element.
14. A method according to any one of the preceding claims wherein the stalk is fed
- 20 to the bending element by means of a feeder means.
15. A method according to claim 14 wherein the feeder means is a pair of rollers through which the stalk is drawn.
- 25 16. A method for processing at least one plant stalk having a fibrous outer part (skin) and an inner hurd, the method comprising the steps of:
 - striking the at least one plant stalk at at least one location along the stalk length with a primary strike so as to cause the stalk to bend at the at least one location thereby causing fracture of the hurd across the stalk at each striking location so as to expose at
 - 30 least part of the hurd and optionally split that skin longitudinally; and
 - striking the at least one plant stalk with a secondary strike so as cause splitting or further splitting of the skin so as to separate the fractured fragments of the hurd from the skin.
- 35 17. A method according to claim 16 wherein the primary strike is followed substantially immediately by the secondary strike.

18. A method according to any one of the preceding claims comprising the additional step of observing the growth pattern of the plant stalk(s) and harvesting the plant stalk(s) at a predetermined phase of growth of the plant stalk(s) prior to 5 processing of the plant stalk(s).

19. A method according to claim 18 wherein the processing is commenced when the plant stalk(s) are green.

10 20. A method according to claims 18 or 19 wherein the plant stalk(s) are harvested at about 50 to about 80 days maturity.

21. A method according to any one of claims 18 to 20 wherein the plant stalks are harvested before the formation of lignin.

15 22. A method according to any one of claims 18 to 21 wherein the plant stalks are harvested before the skin thickens.

23. A method according to any one of claims 18 to 22 wherein the plant stalk(s) are harvested before the outer fibre forms bundles.

20 24. A method according to any one of claims 18 to 23 wherein processing of the plant stalk(s) is commenced within about two hours of harvesting.

25 25. A method according to any one of claims 18 to 24 wherein processing the plant stalk(s) is commenced substantially immediately after harvesting.

26. A method according to any one of claims 18 to 25 wherein processing of the plant stalk(s) is commenced not more than about 15 minutes after harvesting.

30 27. A method according to any one of claims 18 to 26 wherein processing of the plant stalk(s) is commenced not more than about 2 minutes after harvesting.

28. An apparatus for processing stalk having a fibrous outer part (skin) and an inner 35 hurd comprising:
a feeder for feeding the stalks for processing;

a decorticator for decorticating the fed stalks comprising:
a bending element to which the stalks are fed at a predetermined speed; and
one or more striking means comprising a first striking element and a second
striking element and wherein the striking means causes each stalk to bend over the
bending element and to thereby fracture the hurd across the stalk and/or longitudinally
split the skin at various locations along the stalk length, wherein the striking means
further serves to separate the hurd from the fibrous outer part of the stalk.

5 29. An apparatus according to claim 28 wherein the bending element is a blunt
10 bending element.

30. An apparatus according to claims 28 or 29 wherein the bending element is an
element having a small radius edge.

15 31. An apparatus according to any one of claims 28 to 30 wherein the bending
element is, or forms part of, a plate.

32. An apparatus according to any one of claims 28 to 31 wherein the bending
element is in the form of a blade.
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33. An apparatus according to any one of claims 28 to 32 wherein the bending
element is in the form of a hump.

34. An apparatus according to any one of claims 28 to 33 wherein the stalks are
25 manually fed into the decorticator.

35. An apparatus according to any one of claims 28 to 34 wherein the means of
feeding the stalks into the decorticator is by automated means.

30 36. An apparatus according to any one of claims 28 to 35 wherein the means of
feeding the stalks into the decorticator is by means of one or more pairs of feeder
rollers through which stalks are fed and guided for entry into the decorticator.

37. An apparatus according to claim 36 wherein the feeder rollers include a
35 cylindrical surface that is textured so as to achieve sufficient grip of the stalks.

38. An apparatus according to claim 37 wherein the texturing is provided by a series of projections extending along the roller length.
39. An apparatus according to any one of claims 28 to 38 wherein the one or more striking means are located a conveyor.
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40. An apparatus according to claim 39 wherein the one or more striking means located on the conveyor travel transversely to the direction of movement of the stalk(s) fed to the bending element wherein the striking means extend substantially
 - 10perpendicularly to the conveyor.
41. An apparatus according to any one of claims 28 to 38 wherein the one or more striking means are vanes located on a rotor.
- 15 42. An apparatus according to any one of claims 28 to 41 wherein the striking means, the bending element and feeding means co-operate and wherein either the striking means and/or the bending element and/or the feeding means are adjustable so as to achieve optimal decortication.
- 20 43. An apparatus according to any one of claims 28 to 42 wherein the position of the striking means is fixed while the position of the bending element and/or the feeding means is adjustable in relation to the striking means.
- 25 44. An apparatus according to any one of claims 28 to 42 wherein the striking means is adjustable whilst the feeding means and/or bending element are fixed.
45. An apparatus according to any one of claims 28 to 44 wherein the striking means comprises first and second striking elements wherein the first and second striking elements are configured so as to allow the stalk to receive a primary and
 - 30secondary strike wherein;
 - the primary strike occurs by striking the stalk at at least one location along the stalk length with the first striking element over a bending means so as to cause the stalk to bend at the at least one location thereby causing fracture of the hurd across the stalk at each striking location so as to expose at least part of the hurd and optionally split that
 - 35 skin longitudinally; and

the secondary strike occurs by striking the stalk with the second striking element so as cause splitting or further splitting of the skin so as to separate the fractured fragments of the hurd from the skin.

- 5 46. An apparatus according to any one of claims 28 to 45 wherein the first and second striking elements are formed separately and the second striking element is attached to the first striking element and wherein the end of the second striking element extends beyond the end of the first striking element.
- 10 47. An apparatus according to claim 28 to 46 wherein the first and second striking elements are formed as a monolith.
48. An apparatus according to claim 47 wherein the monolithic striking means is formed from a mouldable material.
- 15 49. An apparatus according to any one of claims 28 to 48 wherein the speed at which the striking means strikes the stalk(s) is able to be controlled and/or adjusted to a desired speed setting.
- 20 50. An apparatus according to any one of claims 28 to 49 wherein the location of the striking means in relation to the bending element may be adjusted so as to achieve a desired distance between the bending element and the stalk striking point of the first and/or second striking elements.
- 25 51. An apparatus according to any one of claims 28 to 50 wherein the desired distance from the end of the first striking element to the bending element is about the width of the stalk.
- 30 52. An apparatus according to claim 50 or 51 wherein the desired distance from the end of the first striking element to the bending element is about 10 to 15 mm.
53. An apparatus according to any one of claims 50 to 52 wherein the desired distance from the end of the second striking element to the bending element is about the thickness of the skin.

54. An apparatus according to any one of claims 50 to 53 wherein the desired distance from the end of the second striking element to the bending means is about 0.2 mm to about 2.0 mm.

5 55. An apparatus according to claim 41 wherein the radial length of the striking vanes are adjustable to suit the thickness of the particular type of stalk(s) being processed.

10 56. An apparatus according to any one of claims 28 to 54 wherein the speed of the striking means is greater compared to the speed at which the stalks are fed to the decorticator.

15 57. An apparatus according to any one of claims 28 to 56 wherein the alignment of the bending element in relation to the striking means may be adjusted.

58. An apparatus according to any one of claims 28 to 57 wherein the second striking element is able to scoop the hurd from the skin.

20 59. An apparatus according to any one of claims 28 to 58 wherein the apparatus further comprises a scoop that is able to scoop the hurd from the skin.

60. An apparatus according to claim 59 wherein the scoop is located on the striking means.

25 61. An apparatus according to any one of claims 28 to 58 wherein the apparatus further comprises an air flow device, the air flow being capable of entraining at least part of the separated hurd.

30 62. An apparatus according to claim 41, wherein the striking vanes are able to induce air flow.

63. An apparatus according to claim 62 wherein the airflow induced by the striking vanes is augmented by the use of additional non-striking vanes.

64. An apparatus according to claim 61 wherein the air flow device comprises one or more jets and/or ducts associated with, or capable of being associated with, a source of air.

5 65. An apparatus according to any one of claims 64 to 64 wherein the air flow carries water droplets, mist or vapour to increase the air-flow effect and/or to control the moisture content.

10 66. An apparatus according to any one of claims 28 to 64 wherein the apparatus further comprises one or more guard means to substantially prevent the skin from wrapping around the striking means.

15 67. An apparatus according to claim 66 wherein the guard means is/are one or more thread guard plates.

68. An apparatus according to claims 28 to 67 wherein the striking means are powered from a harvester.

20 69. An apparatus according to any one of claims 28 to 68 wherein the striking means are powered from a petrol engine.

70. An apparatus according to any one of claims 28 to 69 wherein feeding means are powered by one or more separate drive motors.

25 71. An apparatus according to any one of claims 28 to 70 further comprising a slatted conveyor, wherein the separated hurd falls through the slats of the conveyor while the skin is conveyed on the slats of the conveyor.

30 72. An apparatus according to any one of claims 28 to 71 wherein the apparatus comprises one or more bags located at one or more output ends, which serve to collect the separated hurd and skin fractions.

35 73. An apparatus according to any one of claims 28 to 72 wherein the apparatus further comprises a vacuum extraction arrangement for removal by extraction of the separated hurd and skin fractions from the apparatus.

74. A striking means for use in processing plant stalk having a fibrous outer part (skin) and an inner hurd, the striking means comprising first and second striking elements wherein the first and second striking elements are configured so as to allow the stalk to receive a primary and secondary strike wherein;

5 the primary strike occurs by striking the stalk at at least one location along the stalk length with the first striking element over a bending element so as to cause the stalk to bend at the at least one location thereby causing fracture of the hurd across the stalk at each striking location so as to expose at least part of the hurd and optionally split that skin longitudinally; and

10 the secondary strike occurs by striking the stalk with the second striking element so as cause splitting or further splitting of the skin so as to separate the fractured fragments of the hurd from the skin.

75. A striking means according to claim 74 wherein the first and second striking elements are formed separately and the second striking element is attached to the first striking element and wherein the end of the second striking element extends beyond the end of the first striking element.

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76. A striking means according to claim 74 or 75 wherein the first and second striking elements are formed as a monolith.

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77. A striking means according to claim 76 wherein the monolithic striking means is formed from a mouldable material.

25 78. A striking means according to any one of claims 74 to 77 wherein the speed at which the striking means strikes the stalk(s) is able to be controlled and/or adjusted to a desired speed setting.

30 79. A striking means according to any one claims 74 to 78 wherein the location of the striking means in relation to the bending element may be adjusted so as to achieve a desired distance between the bending element and the stalk striking point of the first and/or second striking elements.

35 80. A striking means according to claim 79 wherein the desired distance from the end of the first striking element to the bending element is about the width of the stalk.

81. The striking means according to claim 80 wherein the desired distance from the end of the first striking element to the bending element is about 10 to 15 mm.

82. The striking means according to claim 79 wherein the desired distance from the 5 end of the second striking element to the bending element is about the thickness of the skin.

83. The striking means according to claim 78 wherein the desired distance is about 0.2 mm to about 2.0 mm.

10 84. A striking means according to any one of claims 74 to 83 wherein the alignment of the bending element in relation to the striking means may be adjusted.

15 85. A striking means according to any one of claims 74 to 84 wherein the striking means are located on a conveyor.

86. A striking means according to claim 85 wherein the one or more striking means located on the conveyor travel transversely to the direction of movement of the stalk(s) fed to the bending element wherein the striking means extend substantially 20 perpendicularly to the conveyor.

87. A striking means according to any one of claims 74 to 86 wherein the striking means are vanes located on a rotor.

25 88. A striking means according to claim 87 wherein the radial length of the striking vanes are adjustable so that they may be increased or decreased to suit the thickness of the particular type of stalk(s) being processed.

89. A striking means according to any one of claims 74 to 88 wherein the second 30 striking element is able to scoop the hurd from the skin.

90. Fibre produced according to the method of any one of claims 1 to 28.

91. Fibre produced by the use of the apparatus according to any one of the claims 29 35 to 74.

91. Hurd produced according to the method of any one of claims 1 to 27.
92. Hurd produced by the use of the apparatus according to any one of the claims 28 to 73.